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The influence of motivation in modifying the effect of adjunct questions was explored. Each of 270 undergraduates were promised 0, 3, or 10 cents for each correct answer on a test given immediately after reading. Questions were placed either frequently or infrequently in a text, either before or after the relevant material. Controls read the text without adjunct questions. Results indicated that (1) learning was contingent upon how much money the subjects were offered for performing; (2) that the advantage of post-questions over prequestions diminished under high incentive; (3) that prequestions inhibited incidental learning when they were frequent; and (4) that infrequent adjunct questions resulted in a take-over by the incentive factor. It was concluded that inhibitory effects of questions may operate during the selection of text input and during the further processing of that input from short-term memory. References, notes, and tables are included. (MD)

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Frase

Abstract

This study explored the influence of motivation in modifying the effect of adjunct questions. 270 undergraduates were promised 0, 3, or 10¢ for each correct answer on a test given immediately after reading. Questions were placed either frequently or infrequently in a text, before or after the relevant material. Controls read the text without adjunct questions. Learning was contingent upon how much money Ss were offered for performing. The advantage of post- over prequestions diminished under high incentive. Prequestions inhibited incidental learning when they were frequent. Infrequent adjunct questions resulted in a take-over by the incentive factor. Inhibitory effects of questions may operate during the selection of text input and during the further processing of that input from short-term memory.

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Effect of Question Position and Frequency Upon Learning from Text under Different Levels of Incentive

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A number of studies, summarized in an article by Frase (1968a), have established that the frequency, and position of questions interspersed in text influence what is learned. Postquestions are generally more effective than prequestions, and greater control of learning is achieved when questions are frequent. Consistent effects have been obtained with different materials and different Ss.

But we have observed that these effects are more apparent when the experimental Ss only participate to satisfy some course requirement. The questioning effects are least obvious for the relatively difficult learning items. These informal observations suggest that the undergraduate, who performs only as a course requirement, or for some minimal reward, may lack proper incentive. Hence, we became concerned with the generality of the previous findings, for they might pertain especially to poorly motivated Ss. In order to determine a range of motivational conditions to which previous findings might apply, we varied incentive by paying Ss different amounts for learning text.

Other variables, the effects of which might be limited by motivational factors, were question position, frequency, and whether the performance measures were the test items which had been seen in the text (relevant learning items), or those which were not previously seen (incidental learning items) -- testing information other than that relating to the relevant items. In previous studies it was found that the advantage of postquestions was greatest when questions were most frequent, and that the advantage of relevant learning over incidental learning was also greatest when questions were frequent.

Method

Subjects

Two-hundred and seventy educational psychology students were randomly assigned to the experimental conditions.

Materials

Twenty paragraphs of biographical text, taken from a 2000-word passage in an introductory psychology text (Miller, 1962), were presented on separate pages as the experimental materials.[1] Two multiple choice five-alternative factual questions were derived from each paragraph. Of these 40 questions, 20 (one from each section) were randomly selected to serve as the relevant content. These relevant questions were presented on separate pages and were seen by all Ss (controls excluded) as they read the text. The remaining 20

questions were designated as incidental and only appeared on the criterion test (which also included the 20 relevant items).

For Ss viewing questions frequently during reading, one question preceded or followed each paragraph. For Ss viewing questions infrequently, five questions either preceded or followed each group of five paragraphs. The control groups read the passages without seeing the relevant questions.

Procedure

Upon reporting for the experiment, Ss were randomly assigned the sealed experimental packets, numbered from 1 to 3, which contained the text, test, and IBM scoring sheet. A set of standard instructions was read to Ss. The Ss were told that the study was concerned with how people learn from written materials. They were told to read each page in order, without looking back once they had read a page, and they were to go directly to the posttest after finishing the reading. If there was a 1, 2, or a 3 on their packet, they would be paid 0¢, 3¢, or 10¢ respectively, for each correct posttest response. They were instructed to record the time (written on the board at 1-min. intervals) when they finished the test, and were informed that there would be no time limit.

Design

Dependent measures were time and criterion posttest scores. A 3 X 3 analysis of variance compared the 0¢, 3¢, and 10¢ incentive conditions at three question levels; control, prequestion and postquestion. A 2 X 3 X 2 X 2 analysis (controls

excluded) included the following factors: question position (pre- or postquestion), incentive level (0¢, 3¢, or 10¢), frequency of questions (frequent or infrequent), and test item type (relevant or incidental). There were repeated measures on the last factor.

Results

Figure 1 presents the mean overall criterion test scores for all question groups at different levels of incentive.

Insert Figure 1 about here

The mean for the postquestion groups was 29.76, for the controls 28.67, and for the prequestion groups 27.74; $F = 4.61$, $df = 2/261$, $p < .01$. Only the pre- and postquestion groups differed significantly (Duncan's multiple range test, with significance set at the .05 level, was used for this and all following comparisons). Means for the 0¢, 3¢, and 10¢ incentive conditions were 27.46, 28.84, and 29.87, respectively; $F = 6.66$, $df = 2/261$, $p < .005$. The 3¢ and 10¢ groups differed from Group 0¢, but not from each other. The interaction between question condition and incentive was not significant; $F = 1.74$, $df = 4/261$, $p < .2$. At the 0¢ level, the postquestion group differed from the prequestion group. At the 3¢ level both the control and postquestion groups differed from the prequestion group, while no comparisons were significant at the 10¢ level. The most noteworthy aspects of Figure 1 are the relatively depressed performance of the prequestion group,

the relative advantage of postquestions at the lowest level of incentive, and the similarity of the performance for all groups under high incentive. Evidently, postquestions play an important role in maintaining learning behaviors at lower levels of motivation.

Time was also influenced by question condition (F = 5.28, df = 2/261, $p < .01$). The mean time scores ordered the groups as follows; control, prequestion and postquestion, with the means being 31.92, 33.66, and 33.88 min., respectively. Only the control and postquestion groups differed. Incentive effects were also apparent in time scores (F = 43.27, df = 2/261, $p < .001$). The means for the 0¢, 3¢, and 10¢ levels were 29.92, 33.51, and 36.02 min., all of which differed among each other.

Further analysis, excluding the control groups, confirmed the significance of the question position and incentive main effects (reported above). In addition, relevant learning was greater than incidental (F = 15.3, df = 1/168, $p < .001$). There was also an interaction between question frequency and type of learning (F = 15.3, df = 1/168, $p < .001$). The means for both relevant and incidental items were 14.4 when questions were infrequent, but were 15.1 and 13.6 respectively, when questions were frequent. In short, frequent questioning tended to reduce incidental learning. With the exception of the incentive effect, the above results confirm those found in a previous study (Frase, 1968c).

Figure 2 shows how performance was modified by incentive. Figure 2 reflects the four-way interaction among question

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Insert Figure 2 about here

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position and frequency, incentive, and item type ($\underline{F} = 4.2$, $\underline{df} = 2/168$, $\underline{p} < .025$). The upper right quadrant of Figure 2 reveals that the postquestion group was only slightly affected by incentive conditions, as the frequency of questions changed. For each of the other quadrants it can be seen that when questions were infrequent, the groups rank ordered themselves according to level of incentive. This take-over by incentive factors seems especially clear for prequestions on relevant items. The four way interaction indicates that the expected ordering of incentive factors only occurs when questions are infrequent. In general, incentive effects appeared especially strong for both incidental and relevant learning in the case of the prequestion groups, but the postquestion groups only showed these incentive influences for incidental items.

Figure 3 is provided to indicate the performance of the

Insert Figure 3 about here

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pre- and postquestion groups in relation to the control groups receiving comparable incentive. The fact that the incentive conditions are not level, indicates that the presence of questions may modify the influence of incentive. This effect

was also present in Figure 1, but the probability of this interaction was less than .20. The depressed performance of the prequestion group on incidental learning is especially notable in Figure 3.

Discussion and Summary

In general, the present study supported the contention that the relative advantage of postquestioning tends to be reduced as motivation increases. This result, however, was not due to any deficiency in the learning consequences of postquestions, but rather to improved performance by the prequestion and control groups as incentive increased.

The higher level interactions found in this study bear witness to the fact that the inclusion of motivational factors considerably complicates our attempt to understand the behaviors which underly learning from text. These interactions are perhaps best discussed in terms of the inhibitory consequences of prequestions and the effects of frequency.

Previous research (Frase, 1968b) has suggested that prequestions serve as cues to identify relevant content to which responses are to be made. But responding to relevant stimuli appears to be accompanied by the inhibition of responses to incidental stimuli, as indicated by the debilitated incidental learning of the prequestion groups. In fact, our data seem to suggest that the negative consequences of

stimulus selection can be stronger than the direct instructive effects of prequestions. For instance, when questions were frequent, the prequestion groups scored .77 questions above the controls on relevant test items, but they averaged 2.0 questions below them on the incidental items.

Inhibitory responses may be thought of in terms of an inhibitory response potential which is activated by items in short-term memory. Questions are one class of these items, and consequently selective learning can be directly influenced by question frequency. The present study suggests that inhibitory responses may also be occurring with postquestions. Under frequent questioning, as incentive increased, the postquestion groups tended to fall below the controls on incidental learning. With frequent postquestions, such inhibitory processes might influence the further processing of text from short-term memory.

With infrequent questioning and a large incentive, inhibitory response to incidental items diminished in that Ss in both the pre- and postquestion groups performed above the controls on both relevant and incidental items. However, when questions were frequent, high incentive was not sufficient to overcome the inhibitory effects of those questions on incidental items. Question frequency thus appears to be a contributing factor in modifying the influence of motivational effects. Thus, the contiguity of questions (or other verbal directions) and related content may be a primary factor in

the control of text learning.

In summary, the present study served to qualify the general superiority of postquestions. We failed to replicate the finding that postquestions lead to significantly greater performance than a control. Also of interest, however, was the finding that there seems to be a loss of control over important learning behaviors when questions are infrequent. This loss of control is reflected in a take-over by incentive factors, a reduction in the direct instructive effects of questions, and a reduction in the inhibitory effects of questions on incidental learning. In general, our data suggest that inhibitory responses, which result in the rejection of information, are an important class of mathemagenic (Rothkopf, 1965) activities. The consequences of the stimulus controls that we have employed indicate that there are some fairly direct ways of modifying these activities.

References

Frase, L. T. Questions as aids to reading: some research and theory. American Educational Research Journal, 1968a, 5, 319-332.

Frase, L. T. Some unpredicted effects of different questions upon learning from connected discourse. Journal of Educational Psychology, 1968b, 59, 197-201.

Frase, L. T. Effect of question location, pacing, and mode upon retention of prose material. Journal of Educational Psychology, 1968c, 59, 244-249.

Miller, G. A. Psychology: the Science of Mental Life, New York: Harper and Row, 1962.

Rothkopf, E. Z. Some theoretical and experimental approaches to problems in written instruction. In J. D. Krumboltz (Ed.), Learning and the educational process. Chicago: Rand McNally, 1965, 193-221.

Notes

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Figure Captions

Fig. 1. Mean number of total correct responses on immediate posttest for control and question groups at different levels of incentive. N = 30 for each point.

Fig. 2. Four-way interaction between question position, frequency, incentive and type of test item. N = 15 for each point.

Fig. 3. Performance of question groups plotted in relation to control groups which received the same incentive.

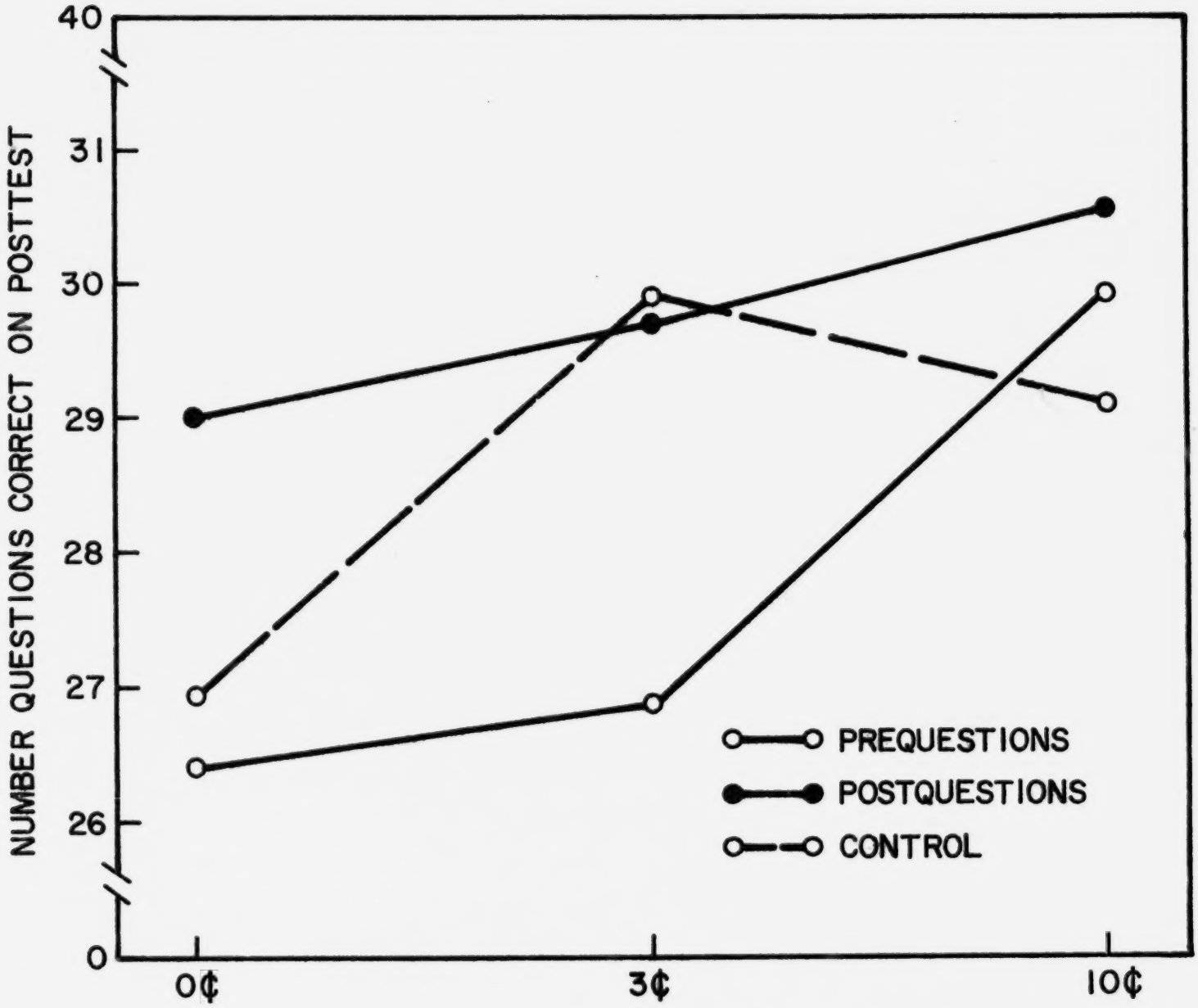
NUMBER QUESTIONS CORRECT ON POSTTEST
40
31
30
29
28
27
26
0
0¢
3¢
10¢
PREQUESTIONS
POSTQUESTIONS
CONTROL

Figure 1.

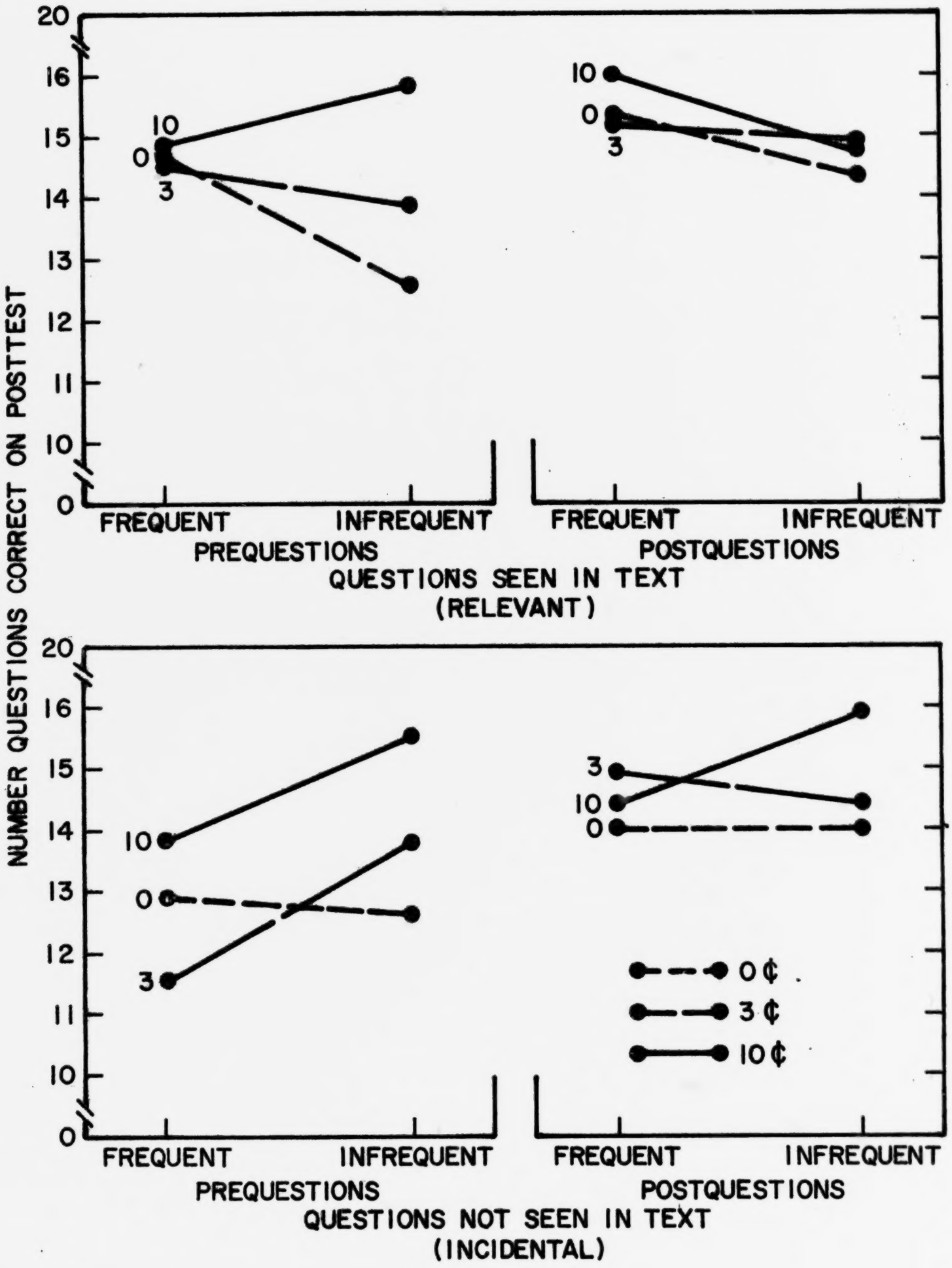
NUMBER QUESTIONS CORRECT ON POSTTEST
20
16
15
14
13
12
11
10
0
10
0
3
FREQUENT
INFREQUENT
PREQUESTIONS
10
0
3
FREQUENT
INFREQUENT
POSTQUESTIONS
QUESTIONS SEEN IN TEXT
(RELEVANT)
20
16
15
14
13
12
11
10
0
10
0
3
3
10
0
0¢
3¢
10¢
FREQUENT
INFREQUENT
PREQUESTIONS
FREQUENT
INFREQUENT
POSTQUESTIONS
QUESTIONS NOT SEEN IN TEXT
(INCIDENTAL)

Figure 2

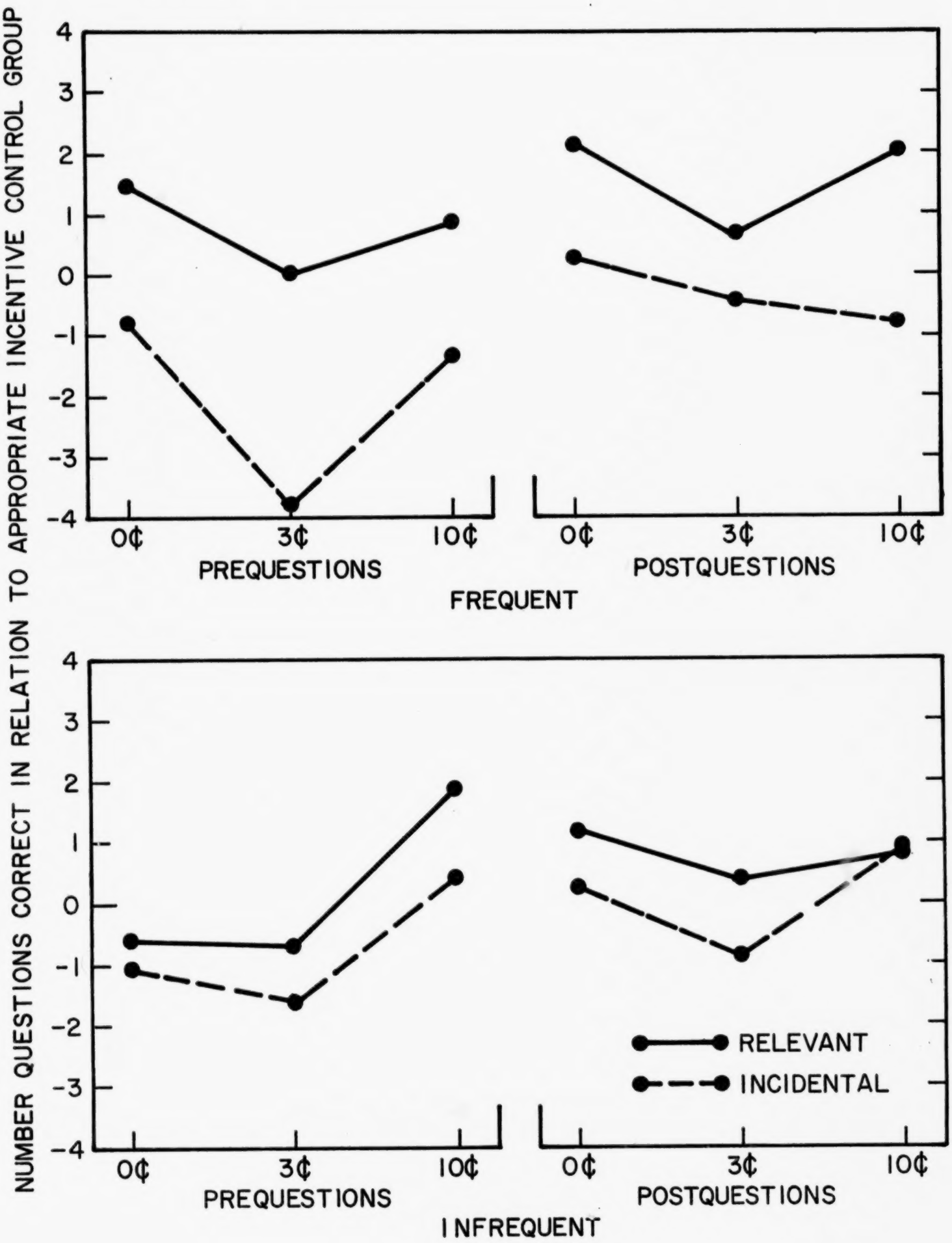
NUMBER QUESTIONS CORRECT IN RELATION TO APPROPRIATE INCENTIVE CONTROL GROUP
4
3
2
1
0
-1
-2
-3
-4
0¢
3¢
10¢
PREQUESTIONS
POSTQUESTIONS
FREQUENT
INFREQUENT
RELEVANT
INCIDENTAL

Figure 3